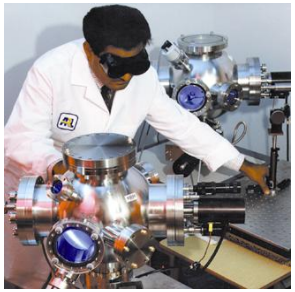
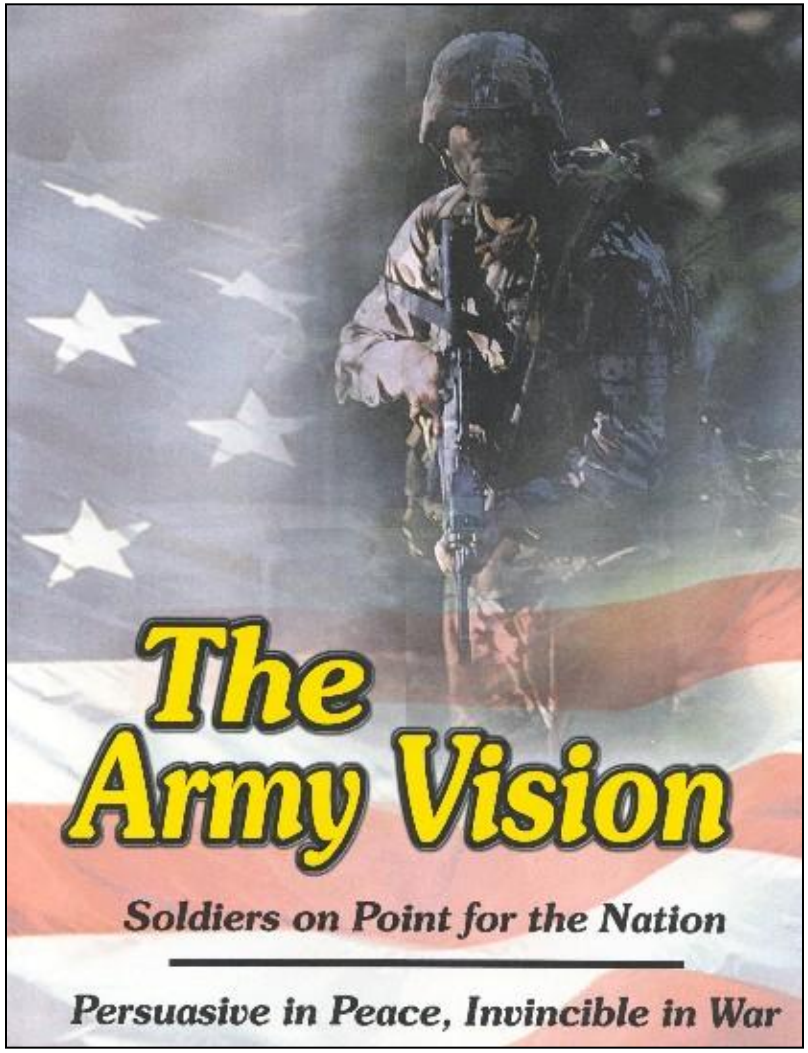
Army Science & Technology ...Accelerating the Pace of Transformation

Armaments for Full Spectrum Warfare Conference & Exhibition

Parsippany, New Jersey

23-25 June 2003



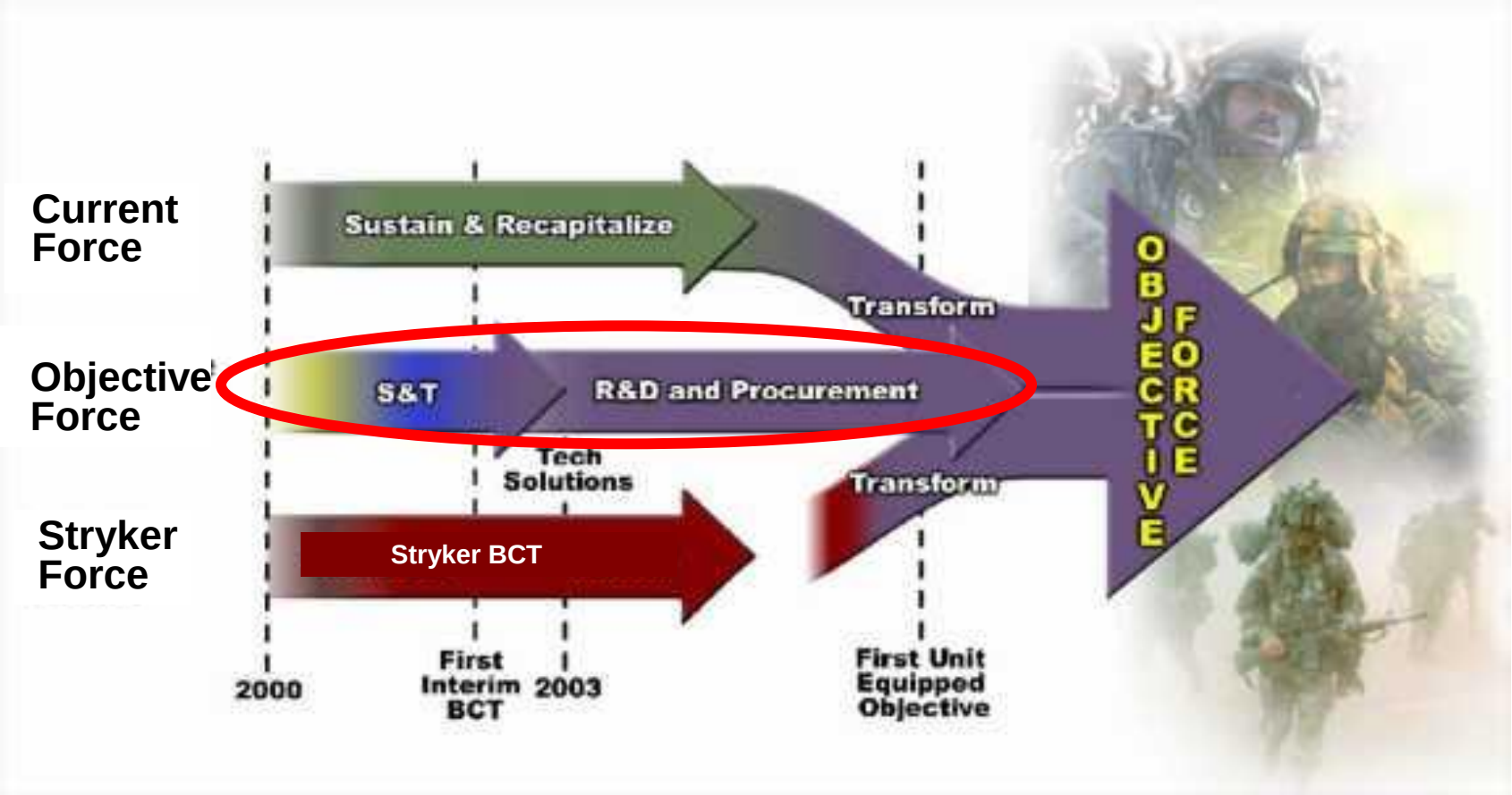


Dr. Marilyn M. Freeman
Deputy Director Armament, Vehicle & Soldier Technologies
Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology

Purpose

- ***To provide an overview of the U.S. Army S&T Transformation Strategy***
- ***To provide an update of selective Future Combat System S&T thrusts with an emphasis on armament and armament related initiatives***

The Army Transformation



"The S&T community is the key to the long term transformation of the Army" - - CSA *Oct 1999, HASC*

Objective Force for Full Spectrum of Missions

Environmental Complexity

High
Urban

Open rolling terrain

Low

Stability and Support Operations

Small Scale Contingencies

Major Theater War

Spectrum of Conflict

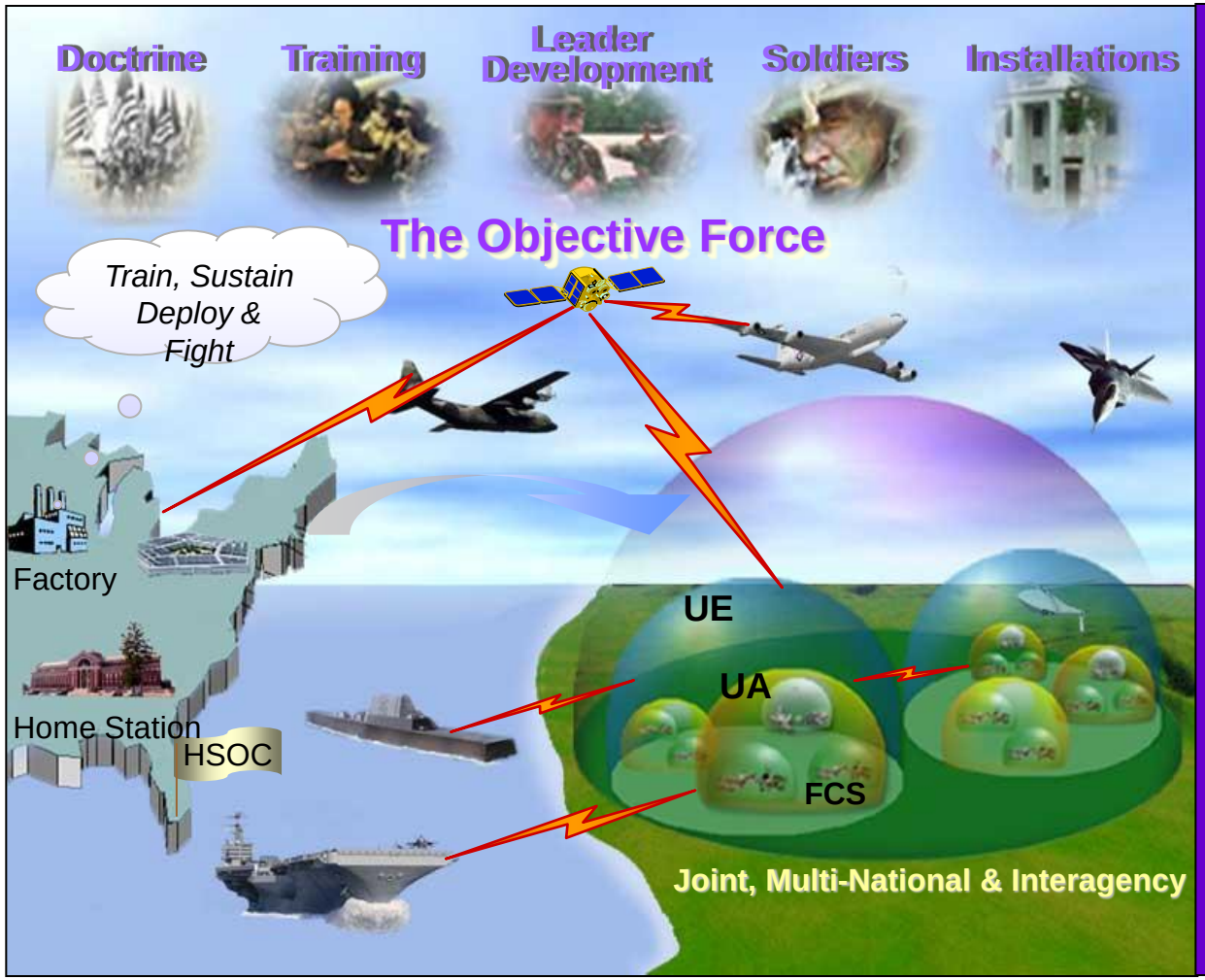
Increased strategic responsiveness

- ✓ Brigade in 96 hrs; Division in 120 hrs; Five Divisions in 30 days
- ✓ Fight immediately upon arrival
- ✓ Simultaneous air and sea lift

Capabilities for an Uncertain Future

Concept of the Objective Force

Objective Force *"Space to Mud"*



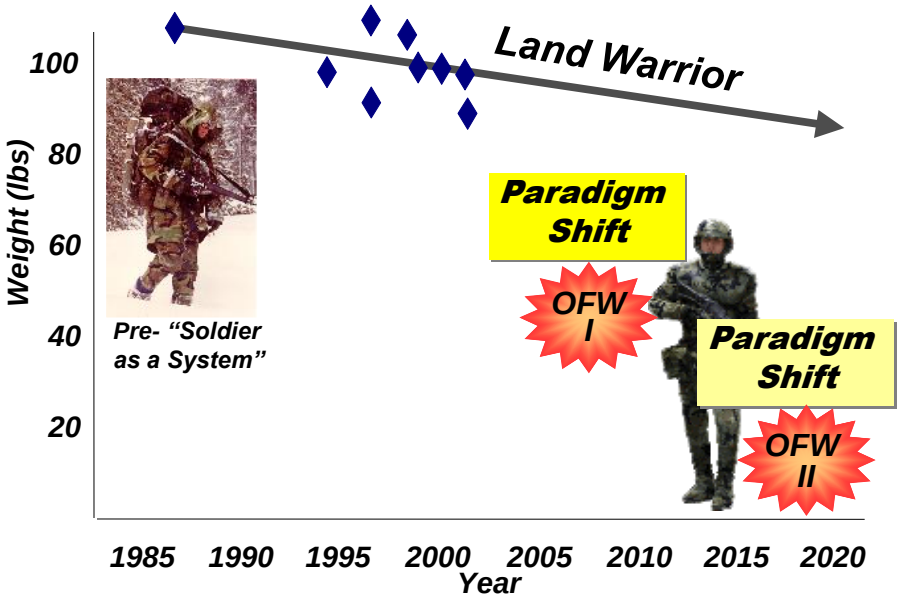
- **Full Spectrum Army -** campaign quality forces with special purpose capabilities
- **Joint & Combined Force -** by design
- **Enabled by Knowledge -** network centric, self-aware and adaptive soldiers and leaders, agility enhanced by advanced technology
- **Adaptive Organizations -**
  - Unit of Action (UA) (Bde) – conducts engagements; enabled by maneuver, maneuver support, and maneuver sustainment from the UE
  - Unit of Employment (UE_1) (Div TF) - conducts battles & precision attacks of key enemy capabilities
  - UE_2 (Corps TF) – conducts campaigns and major operations

Objective Force *"Factory to Foxhole"*

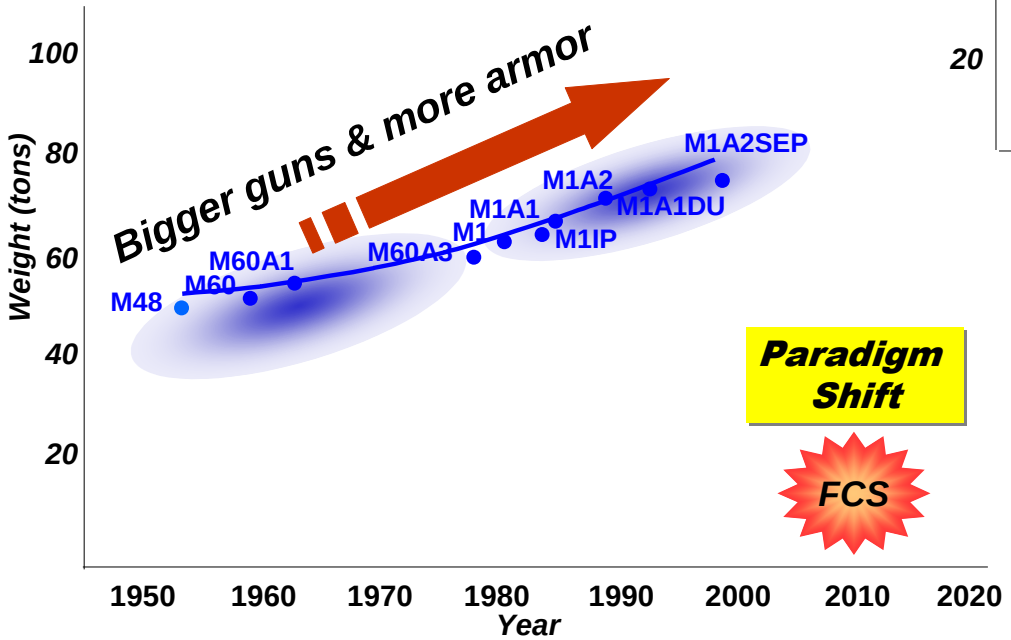
Objective Force Designs
A System of Systems Approach

Transformation Demands Paradigm Shift …

Objective Force Warrior (OFW)

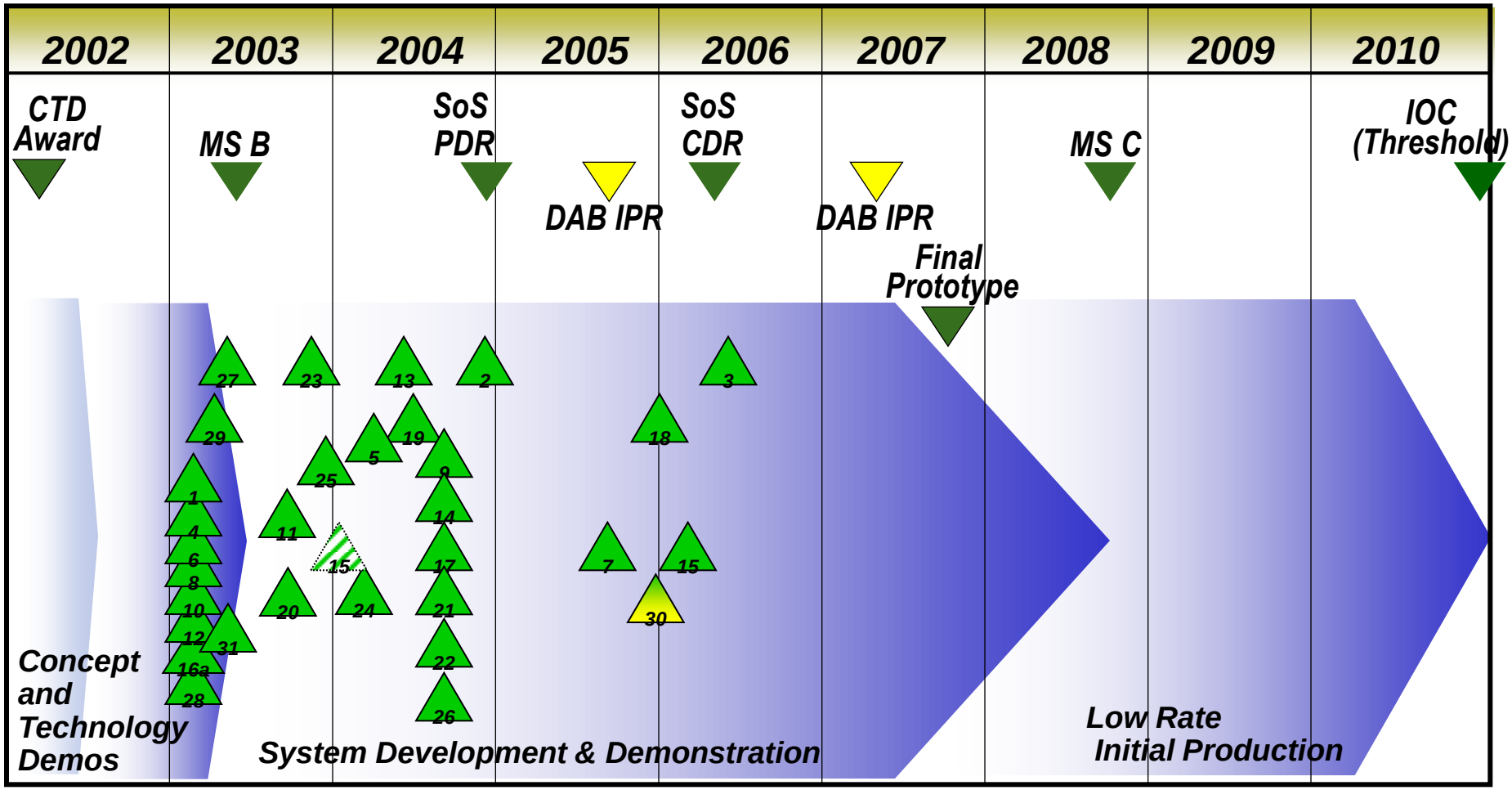


Future Combat Systems (FCS)



…Providing Leap Ahead Capabilities Sooner

FCS Critical Technology Readiness
Supporting Acquisition Schedule

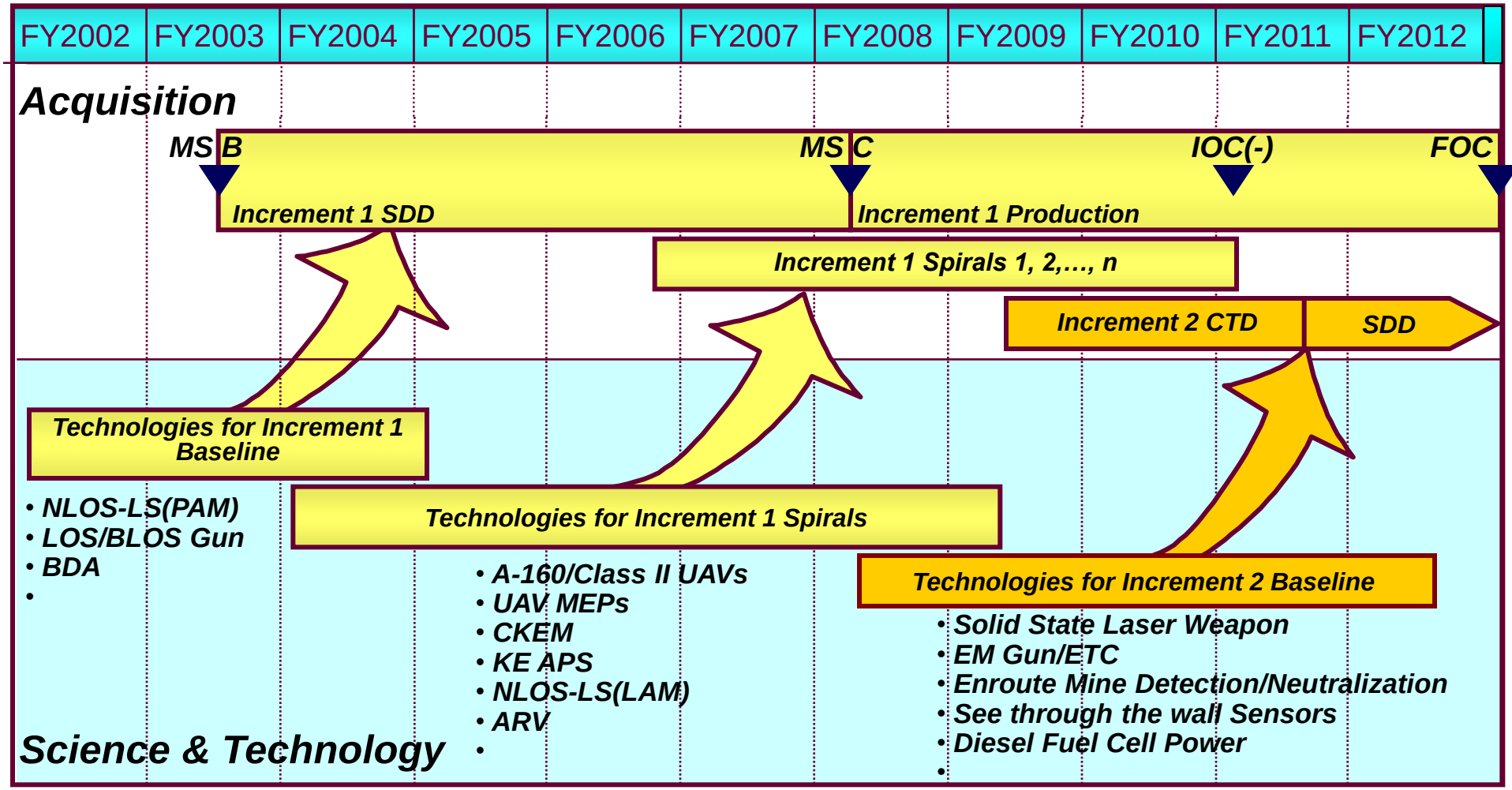


Note: calendar year shown

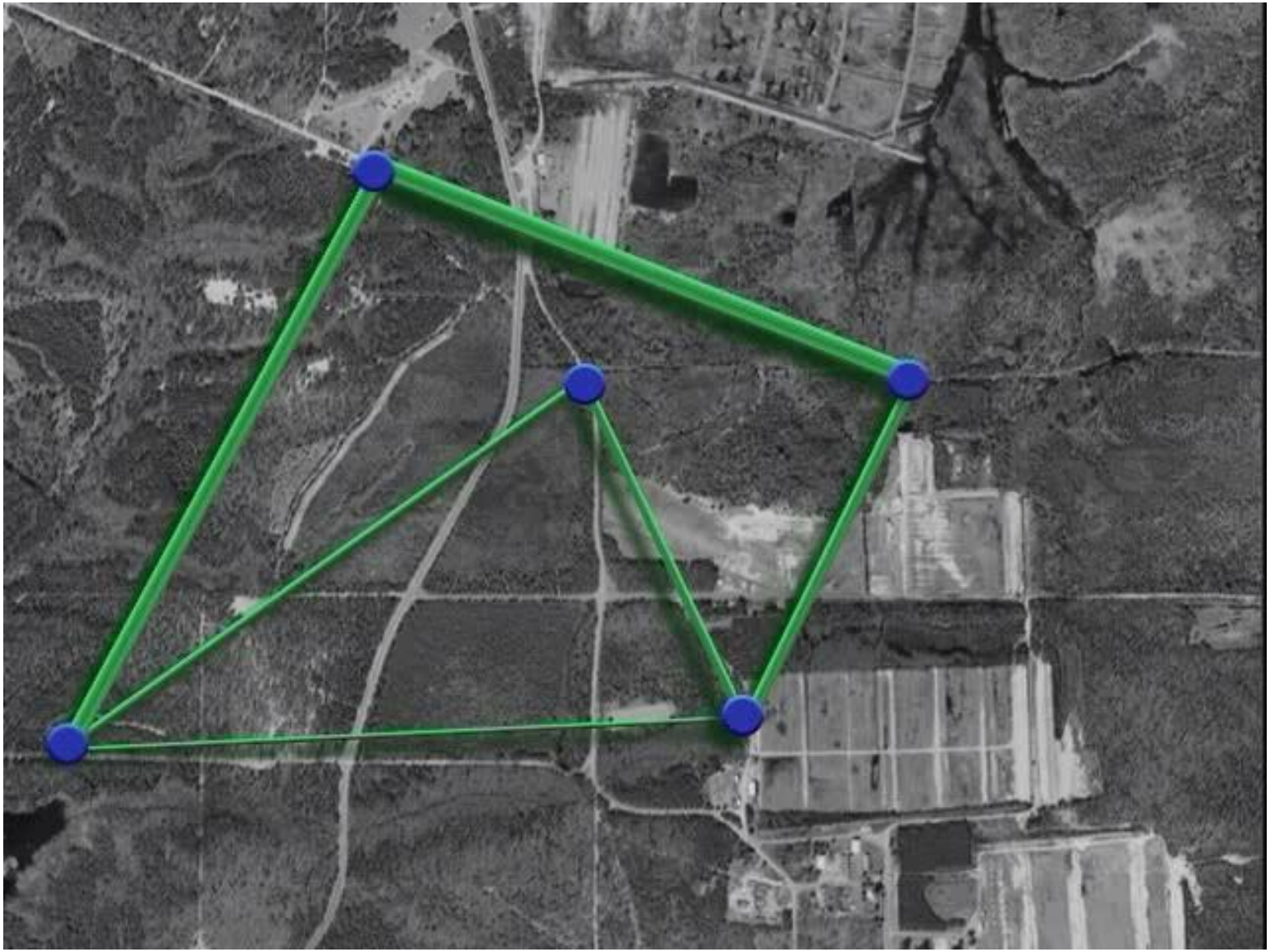
Critical Technology Number

CTs after PDR			
3 Network Security	15 Dual Mode Seeker Precision Munitions		
7 Wideband Waveforms	18 Manned/Unmanned Collaborations	30 Countermine	

S&T Strategy for FCS Spiral Development



Technologies To Build Future Combat Systems In This Decade



FCS Indirect Fire Vehicle

United Defense

S&T Strategy for this Decade

- ***Next Generation of FCS***
- ***Accelerate High Payoff Core Army Technologies***
  - ***Move, Shoot, Communicate and Survive***
  - ***AMC RDE Command -- System of Systems Technology Testbed***
- ***Partner with DARPA for a few new initiatives***
  - ***Find the enemy***
  - ***Autonomy with intent (Robotics)***
  - ***Affordable Combat ID***
- ***Enable Affordable Manufacturing***

Where we are with FCS Technologies Today

OAV

A-160 Hummingbird

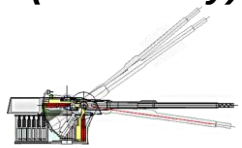
UAV RSTA / Comm Relay

Adv. Sensors

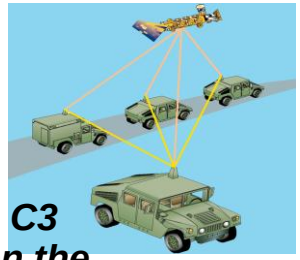
UGCV (150 Kg Payload)

UGCV (2,000 Kg Payload)

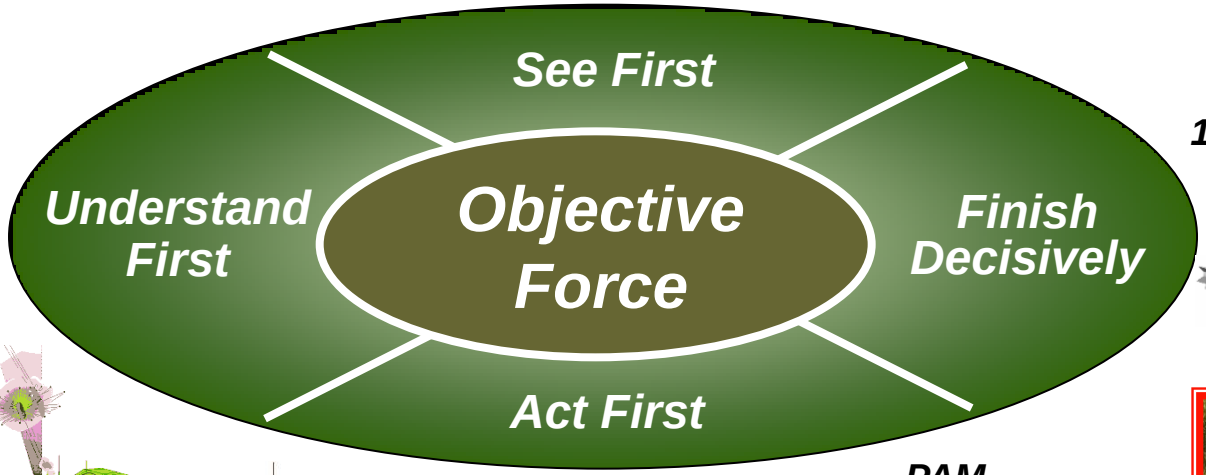
Follower UGVs (Autonomy)

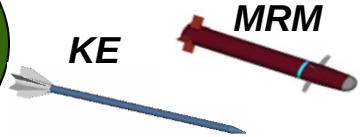


120mm LOS/BLOS ATD



C3 on the Move

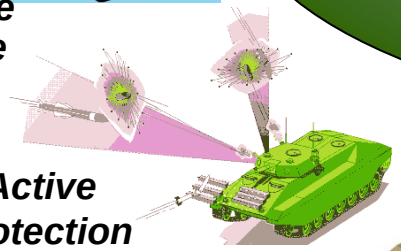




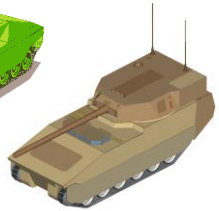
KE

MRM

OCSW

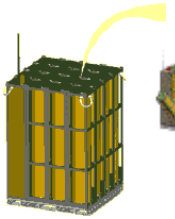


Active Protection

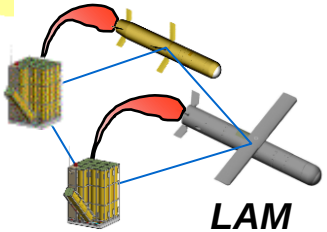


Advanced Mobility

Hybrid Electric Propulsion



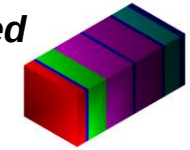
NLOS-LS



PAM

LAM

Integrated Armor



CKEM

Technologies to Build FCS in this Decade

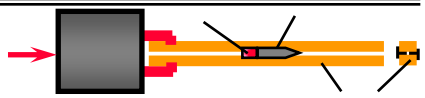
OCSW

Lethality

FY04-09 $1.7B

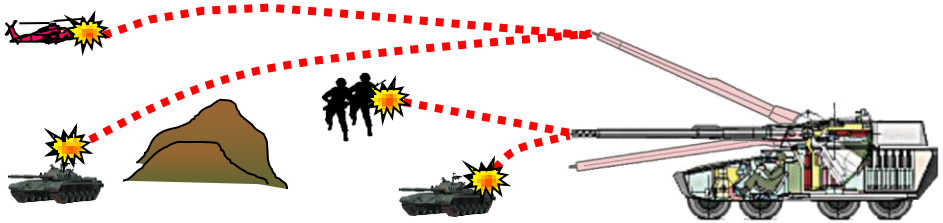
Guns and Munitions … Kill at longer ranges

EM Gun Tech Demo



Validate Hypervelocity Lethality

Multi-mission Capability from a Single Platform

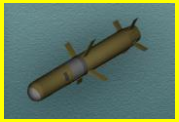


BLOS 2-12km LOS 0-4km

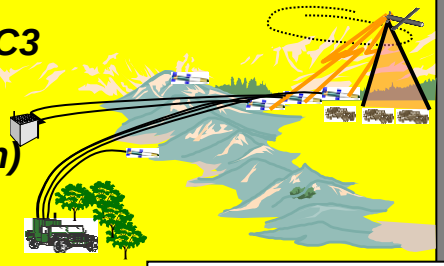
Missiles…Extended Range and Loiter with greater Lethality

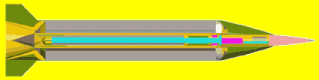
Next Gen NLOS-LS and C3

Loitering Attack Missile (30-60 min)



Precision Attack Missile (>40km)





Compact Kinetic Energy Missile

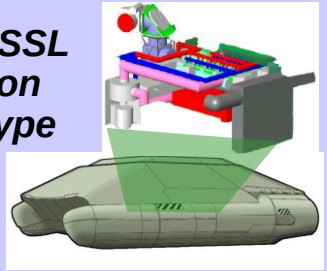
Maintain Lethality w/ Increased Stowed Kills

Directed Energy …Tunable Lethality

Solid State Laser (SSL) Technology

Speed of Light Engagement

100kW SSL Weapon Prototype



- Precision Fires
- Overwhelming Lethality at Longer Ranges
- Reduced Logistics

Power and Energy…
… Pervasive and Enabling

POWER GENERATION

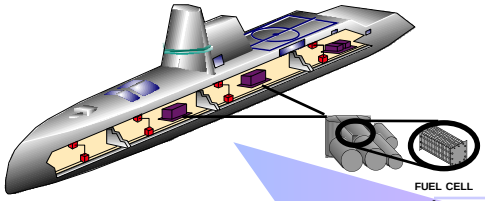
- Fuel Cells & Fuel Reforming
- Novel Power

ENERGY STORAGE

- Batteries
- Capacitors

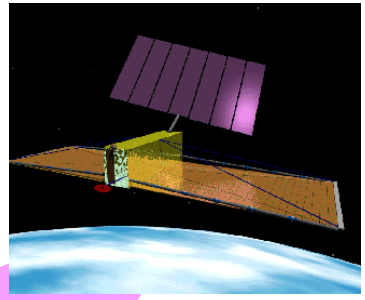
POWER CONTROL AND DISTRIBUTION

- Switching & Conditioning
- Power Transmission & Distribution
- Thermal Management

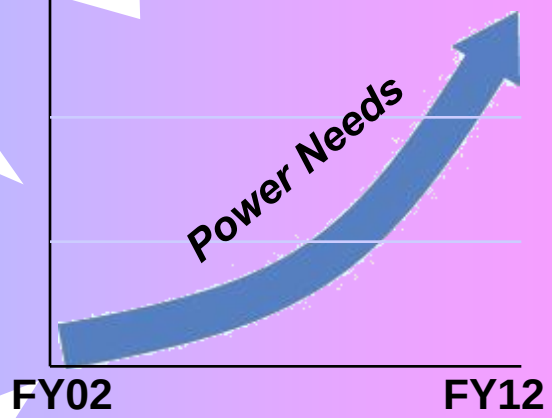


Electric Warship

More Electric Aircraft

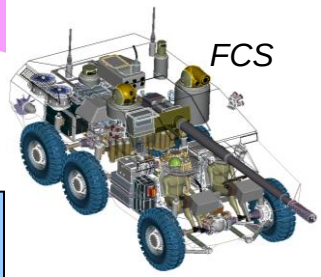


Space Based Radar



Warrior

High Power Microwave



FCS

Electric/Hybrid Weapons

New Operational Capabilities

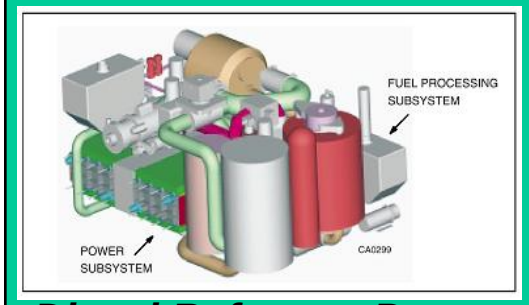
Power and Energy Technologies

FY04-09 $0.6B

FCS Vehicle Power

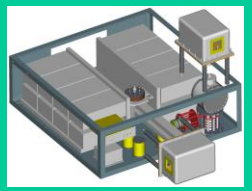
- All Electric vehicles
- Fuel efficiency
- Silent mobility

Hybrid Electric Drive



Diesel Reformer Power

- Minimize deployment time
- Self Sustainment
  - 3 days - High optempo
  - 7 days - Low optempo
- New capabilities
  - Lethality
  - Survivability



Pulse Power for...
Electric Weapons & Protection
6x Power Density

Soldier System Power

- Reduce weight
- Increased power
- Increased mission time

Microturbine/
Microengines

10x Power Density

Electric Power- A key enabler of US Army Objective Force Transformation

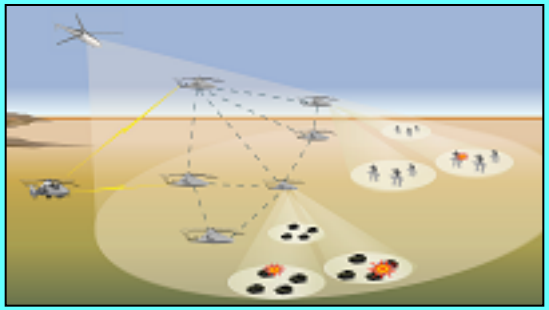
- ***Sustainment - Improved fuel economy – 20-50% depending on hybrid configuration and mission (reduced logistics)***
- ***Mobility -Improved stability resulting from HEV design flexibility***
  - ***Typically lower vertical center of gravity***
  - ***More advantageous weight distribution***
- ***Agility -Improved acceleration and slope performance (instantaneous torque)***
- ***Silent Watch and Silent Mobility (improved energy storage- e.g. high energy batteries)***
- ***Advanced survivability and lethality opportunities***
  - ***Electric Armor***
  - ***EM Gun***
  - ***Directed Energy Weapons***

Unmanned Systems

Paradigm Shifts in Warfighting Capability

FY04-09 $0.9B

Acting First…Extending the Battlespace



Unmanned Combat Armed Rotorcraft

1,000 lbs and 8 hrs

Autonomous Teaming

Unmanned Ground Vehicles

Armed Reconnaissance Vehicles

Autonomous Combat Operations with Unmanned Systems

Assured comms and situational awareness

A-160 Hummingbird

1,000 lbs and 40 hrs

Organic Air Vehicle (OAV)

~10 lbs and 1 hr

Micro Air Vehicle (MAV)

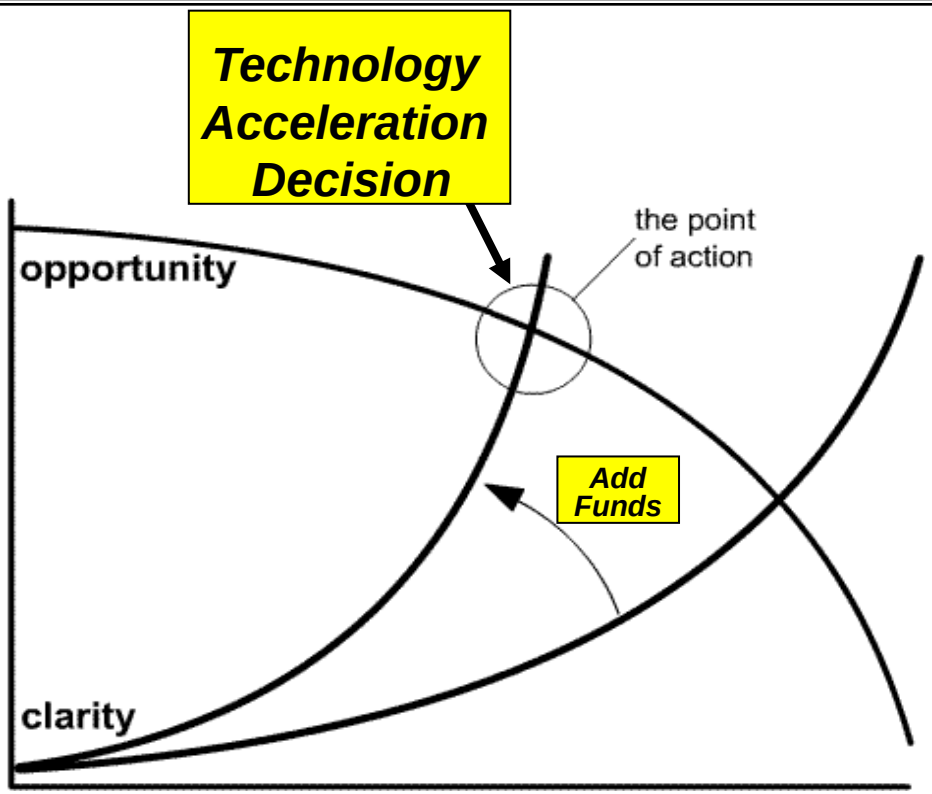
<1 lb and 30 mins

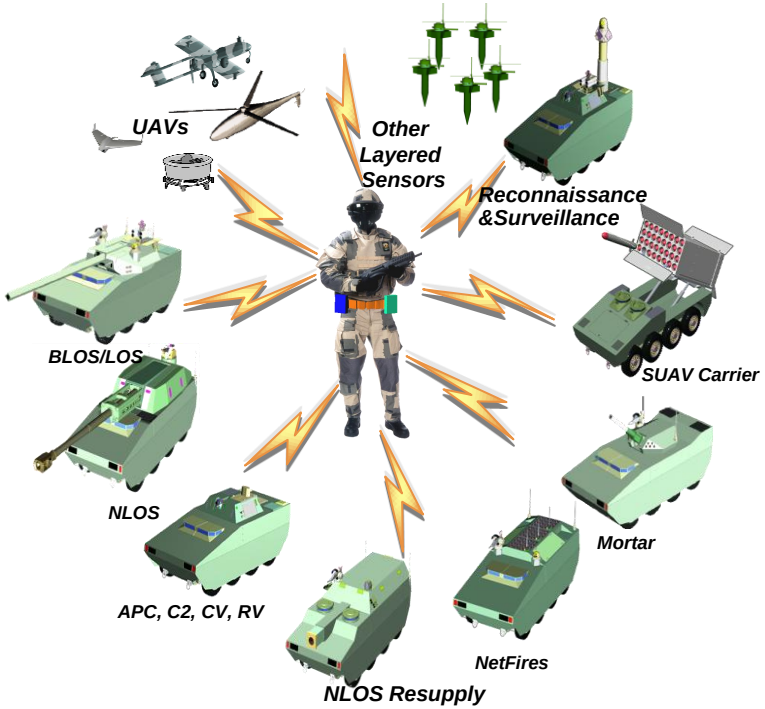
Unmanned Systems Technical Challenges

- ***Perception – software driven***
  - ***Obstacle classification/avoidance***
  - ***Understanding (e.g. rain+soil=mud)***
  - ***Decision processes***
- ***Platforms and characteristics***
  - ***UGV's – mobility, agility***
  - ***UAVs –payload, range, operating conditions, recovery***
- ***Situational Behavior***
  - ***Independent***
  - ***Cooperative***
- ***Soldier Interface***
  - ***Operating techniques/limitations***
  - ***How much/frequent, under what conditions human intervention?***

As technology matures it will be applicable to a greater variety of combat roles and will enable greater confidence in postulating the conditions under which unmanned platforms should be used.

Where we are going…

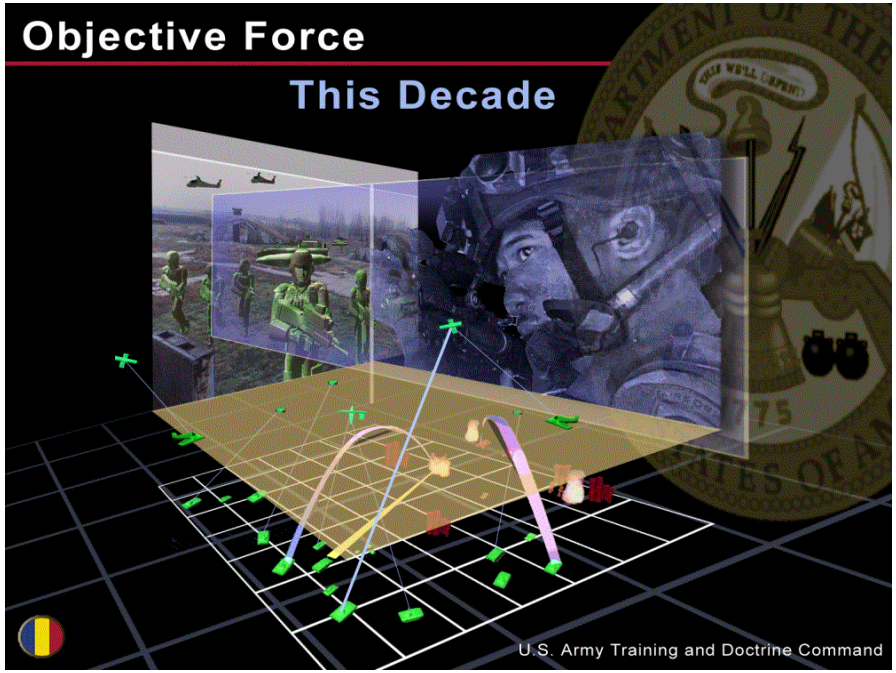




Fourth Generation R&D, Miller and Morris, 1999

Now is time to take the first step – FCS is the opportunity

The Army…
On the Fast Track to Transformation



Finishing Decisively

"Our defense review identified six goals that drive our transformation effort:
…Second, we must be able to project and sustain forces

…programs to project and sustain forces in distant theaters—such as…the Future Combat Systems"

Secretary Rumsfeld
February 5 & 6, 2003
House / Senate Armed Services Committees